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32 VICTORIA ST
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LIGHTING IN THE BLEACHING, DYEING, PRINTING, AND FINISHING INDUSTRY

By J. W. HOWELL, D.L.C., M.I.E.E. *(Fellow)*

(Paper to be read before the Manchester Centre (North-Western Area), on October 14, 1943, the Bradford Group (North Midland Area), on January 13, 1944, and Leeds Centre (North Midland Area), at Halifax, on February 7, 1944.)

It was originally intended to incorporate data on this section of the textile industry in the companion papers dealing with the Woollen and Worsted and Cotton sections.* Inquiry has proved that sufficient material exists to warrant a separate exposition of what is a highly important and complicated series of processes, common to certain branches of textiles, but carried out independently of the manufacturing side and forming a definite and separate section of industry.

As in other fields of industry, the lighting engineer, in order to deal adequately with the problems presented, should have at least an elementary knowledge of the following:—

(1) The function of rooms or sheds into which certain processes are grouped.

(2) The particular process involved, which may by its nature materially affect the type of lighting installed.

Experience has shown that the planning of lighting schemes for textile operations by rule-of-thumb methods leads to unsatisfactory results, and that the utility of specifications may be prejudiced by the incorrect use of technical terms. It is proposed, therefore, to analyse and describe briefly the various processes involved.

The Cotton Section.

Let us deal firstly with the cotton side of the industry. Looking at the flow chart of this section it will be seen that a stage was reached where we were left with yarn, plain, uncoloured, or grey (as it is termed), either in weft or warp wound in either cop or hank or on beams. We also had from the plain looms "grey" cloth, without any pattern or colouring added. Now "pattern cloth," that is cloth which has a woven pattern, usually produced by the intersection of coloured weft and which has been woven on either Jacquards or, in the case of simple patterns, on Dobbys, often requires no further colouring and may pass direct to the final processes before marketing. Such material would be fancy towelling, striped sheeting, and so on. In the case of yarn and plain cloth and certain mixed texture materials other processes may be involved in order either to produce coloured cops or hanks or thread for polishing, as in the case of sewing cotton, or lengths of coloured or patterned cloth or printed fabric.

A general chart of these processes showing the various operations is given in Fig. 1, thick type being used, as before, to discriminate between operations where the visual task is elementary and where better seeing conditions are required.

Certain processes are again grouped into certain rooms. Values given are those actually on the operation, and are not necessarily required over the whole area. In almost all cases considerable quantities of either steam in the "wet" processes or dust in the dry processes are present, and there appears to be a much greater need for the use of either vapour-proof fittings or dust-proof visors than in most other industries.

Let us take the processing of cloth first and then deal later with yarn which, although it passes through

* "Lighting in the Woollen and Worsted Industry." Trans. Illum. Eng. Soc. (London), Vol. VII., No. 8. "Lighting in the Cotton Industry." Trans. Illum. Eng. Soc. (London), Vol. VIII., No. 5.

many of the same processes as cloth, differs in some respects.

Grey Room.

As its title suggests, this room is really a store room for the reception of grey cloth or yarn which has been bundled, chained, or warped. Such processes as examination, stamping, sewing, and storage take place, and there is no need for more than a general illumination of between 6 to 10 ft.c.

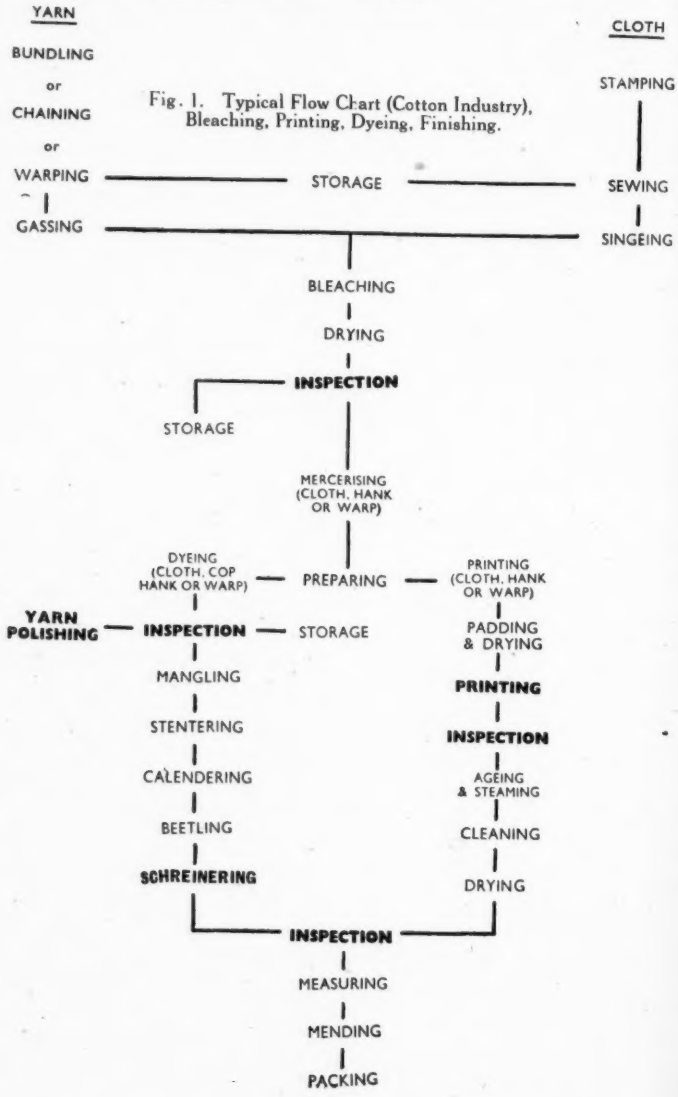

Fig. 1. Typical Flow Chart (Cotton Industry), Bleaching, Printing, Dyeing, Finishing.

Singe House.

Here again the processes are very rough and consist of passing the material over heated plates, which are usually situated to ensure a normal horizontal working plane about 2 ft. 6 in. from the ground. There is always a considerable quantity of dust present.

Bleach Croft.

The processes carried out here include preparation, Kier boiling, bleaching, and washing. Some of the machines, particularly Kier boilers, are bulky and tall, although the process is an enclosed one, and not, therefore, affected by general lighting. There is a certain amount of corrosion from the action of bleach solutions on unprotected metal, but this can usually be removed by dusting. It will also be appreciated that with any washing process a considerable amount of condensation takes place, particularly during week-ends, when operations are suspended.

White Room.

This is where the bleached products or "white" goods are received and made ready for further treatment. The processes are drying, inspection, stamping, sewing, and storage. Again general illumination is all that is necessary, excepting on the actual operation of inspection.

Mercerising.

Here the material, whether it be cloth or yarn, in hank or warp, is given a mercerised finish. This process involves little visual effort, and no purpose is served by using elaborate fittings; they must, however, be easily accessible for cleaning.

White Preparing.

The yarn or cloth is prepared either in bundles or batches for dyeing or wound on to rollers for printing. It is really where the dyeing and printing processes separate. There is no necessity for other than general lighting.

Dyeing Section.

The dyehouse itself does not require anything but good general lighting of between 6 and 10 ft.c. It is not the general practice for any colour matching to be done in the dyehouse itself. Care should be taken in siting fittings, as dye vats are bulky and heavy shadow may easily be cast. Steam is always present. Sometimes, particularly on cold days, the vapour is so thick as to resemble heavy fog. Vapour-proof fittings are essential. Processes are dyeing, mangling, drying, and inspection.

Printing Section.

This section takes the cloth wound on rollers from the white preparing and carries it through to the soft warehouse.

Mangle Padding and Drying.

There is no elaborate process in this section. The material merely passes through rollers and is dried.

Colour Shop.

This is where the colours are mixed to a predetermined formula. The lighting engineer should beware, as whilst from its title it would appear to be necessary to match colours in this shop, this is not so; they are mixed by weight, the matching usually being done by the dyer in an office. There should be good local lighting on the weighing machine.

Engraving Department.

This and the colour shop have not been included on the flow chart, as, although they are important, they are not strictly textile processes. The work consists of designing and etching copper rollers, and is such that it requires special treatment. See under list of processes.

Printing Machine Shop.

In this shop are the machines which actually print the design on the cloth, which is also inspected for faulty print. Great care will be necessary in siting the fittings, as good lighting, preferably of daylight quality, is required.

Ageing and Steaming Department.

There is no exacting task in this department, which can be allocated to the 6 to 10 ft.c. category. Operations are carried out in what can be loosely described as a large steam box which is totally enclosed.

Soaping and Padding Department.

Processes involved simply require general illumination. There is no intricate machinery and the work is

quite elementary. From this stage printing and dyeing processes are common and are united in the soft warehouse.

Soft Warehouse.

This is where the products from both printing and dyeing rejoin a common section. It is mostly storage, although inspection is carried out, for which special provision should be made.

Finishing Department.

There are a number of processes taking place in this department, including mangling, stentering, calendering, beetling, schreinering, and other subsidiaries, concluding with final inspection. Particular care is necessary with schreinering and inspection, otherwise general lighting is sufficient.

Warehouse.

In this final stage the cloth is measured, inspected, minor faults corrected, material made up, and packed. Inspection is the only process necessitating special treatment.

Having dealt with the various departments or rooms, a brief description of the processes involved will help the lighting man to recognise and deal with particular problems which arise. Whilst firms may vary so far as subsidiary operations are concerned, the general and major items are detailed.

Processes and Their Lighting Requirements.

Attention is drawn to the processes indicated in thick type in the flow chart for the cotton industry (Fig. 1). Such processes should be treated with great care. They fall into categories as detailed below:—

(a) Processes which require medium visual perception (10 to 15 ft.c. range).

*Inspection (soft warehouse).
*Hank, warp, or piece printing.
Colour shop.
Schreinering.
Polishing.
Cropping.

(b) Processes which require prolonged visual perception (15 to 25 ft.c. range).

*Dye inspection.
*Printing.
*Final inspection.

(c) Processes which require severe visual perception (25 to 50 ft.c. range).

Etching and engraving.
Burling.
Mending.

(d) Precision processes (range above 50 ft.c.).

*Perching.

* Indicate processes where light of approximately daylight colour is an advantage.

Grey Room Examination.

The cloth is received and roughly examined. This is simply to detect obvious flaws and as a safeguard for the finishing end of the trade against possible defective pieces. It will be remembered that, unlike woollens, it is seldom that grey cloth is perched before leaving the manufacturers. There is no need for other than general lighting.

Stamping.

This operation consists in stamping the pieces of material received with the name of the source of supply. It should be understood that the dyer may receive consignments of material from several sources and must be able to identify them. Little visual effort is necessary, nor is special attention of any kind required.

Sewing.

Pieces of cloth received at bleachworks are often about 100 yards long. Many of these are sewn together very roughly and the cloth goes through the processes in one length. No special light treatment is necessary.

Singeing.

When the cloth is received in its rough state it usually has a good deal of "nap" on its surface. This is usually singed off by passing the cloth at a very rapid rate either over flame or heated plate as the case may be. The corresponding process for yarns is known as "gassing." There is always

a good deal of dust about, composed of the singed "nap," which could cause conflagration by smouldering. Whilst the process is almost automatic and no heavy visual task is present, the use of dust-proof visors is to be recommended and open fittings eliminated. This will ease the maintenance of the system by permitting easy removal of the dust.

Bleaching.

The whole process is one in which the natural colouring matter present in grey cloth or yarn is destroyed by chemical action. For cotton the

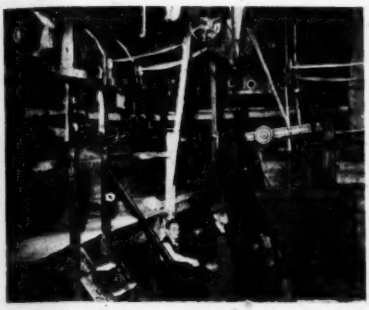

Fig. 2. Kier Boilers. Bulky equipment provides a difficult problem for the lighting engineer. A satisfactory solution can only be determined on site.

active agent is usually chlorine. These processes conclude with washing. Generally water-tight fittings should be used, as condensation takes place.

Kier Boiling.

These boilers are bulky plant totally enclosed, and may easily be 8 ft. wide. As external control is used little lighting is necessary, apart from that required for safety purposes.

Bleaching.

The process consists in passing the cloth or yarn through a bleaching solution. As indicated under the department, whilst there is a certain amount of corrosion showing itself in a furry deposit on metals this is not excessive and does not seem to warrant proofing or acid-resisting material.

Washing.

Simply cleaning the cloth after bleaching to remove any solution left in the cloth or extraneous dirt or dust which may have appeared. Porcelain water-tight fittings are necessary over and near the process, as moisture is always present either in vapour form; or if the department is closed for holidays or week-ends considerable condensation takes place.

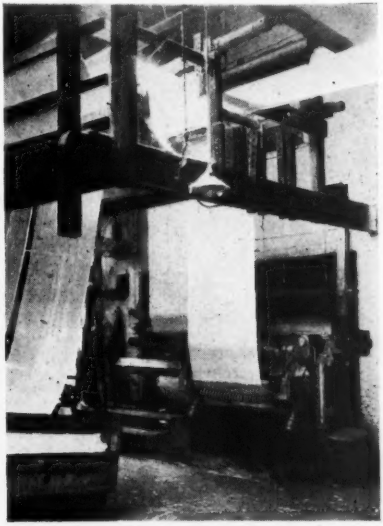

Fig. 3. Drying Machinery. Note the passage of the material overhead and the accumulation of fluff on the obsolete drop pendant. A suggested method of illumination is by means of a visor fitting having also an upward component.

Drying.

After washing the material is taken to the white room, in which it is prepared for mercerising or other processes. It is really a corresponding room to the "Grey" Room, with the difference that it is dealing with white material. The first thing is the drying of the wet material by passing it round heated rollers or over heated horizontal plates.

Inspection.

Again the operation is not exacting. The material is examined to detect imperfect bleaching. As in most other inspection processes fluorescent tubes have been found to be most useful.

Stamping and Sewing.

These are identical with the processes in the Grey Room. Having

been bleached the material requires separation for either printing or dyeing, and, as in the bleaching process, cloth is processed in long lengths. All these preliminary processes are more or less additional to storage.

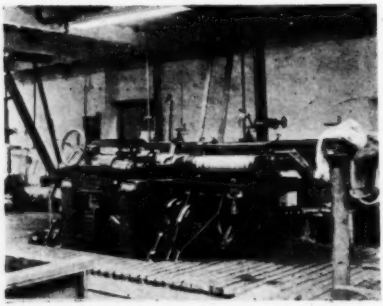

Fig. 4. Mercerising. Although there are no exacting requirements use has been made of the fluorescent tube. The advent of this type of lighting into the Cotton Industry is interesting.

Mercerising.

This is a process of treating cotton yarn or cloth with a mercerising solution which develops a very high sheen on cotton, almost like silk. It may take place in either hank or warp on the yarn side, or in cloth pieces. There are no special requirements.

Preparing, Batching, etc.

Here the cloth is either roughly folded layer upon layer for the dyeing process or run off on to rollers for printing. The process is almost automatic, and general lighting is all that is required. From this stage until the soft warehouse, that is until dyeing or printing is completed, the two sections are independent.

DYEING.

Dyehouse.

The vats are usually high and arranged in rows, and it is customary to arrange lighting fittings immediately above and in front of the vats. Vapour proof fittings should be installed, as steam is almost always present and condensation heavy. Tests have been made with almost every type of known light source, but it is concluded that it is not a question of colour or shape of light source, i.e., point or linear, so much as the need for light capable of penetrating dense vapour. It is not sufficient for the lighting engineer to suggest steam extraction, as this is in most cases unpractical and very often financially impossible. Certain exceptions to general lighting may occur when hoods are fitted to the vats for steam extraction, when bulkhead W/T fittings are used inside the hood.

Mangling.

On leaving the vats the yarn is dried by means of similar apparatus to that used in laundries for water extraction from clothes. It is done by a revolving cage, the process being known as hydro-extraction, which requires no particular attention from the lighting standpoint. Cloth, on the other hand, has its moisture extracted by passing through rollers, and again general lighting is quite sufficient.

Drying and Inspection.

After mangling the material is dried and inspected, though it is usual for the dyer to cut a piece of the finished cloth and to take it to match a customer's sample in his office. Thus in the drying-room no exacting task is being performed.

Dyer's Office.

It is here and in the laboratory that special requirements are necessary. Firms will generally give the dyer any kind of lighting he cares to ask for, as it is most important that colours match correctly. Different individuals prefer different light sources, some prefer colour correcting media for tungsten lamps, whilst others stan-

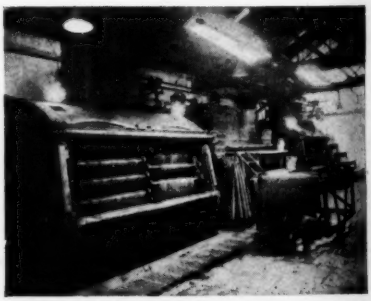

Fig. 5. Dyehouse. The arrangement of Dye Vats in rows limits the mounting of fittings (preferably of vapour proof type) to immediately above in front of vats.

dardise on fluorescent tubes or C.O.2 units. In many laboratories colour corrected light is used, although it is much more necessary to have good general lighting, as the same principle of mixing by weight is applicable.

PRINTING.

Returning now to the white preparing, batching process to deal with the printing side, we had the cloth prepared and wound on to rollers.

Mangle Padding and Drying.

In certain cheap cloths certain filling or padding is added to the original base during this process. The cloth is filled by the cloth rolls passing under filling apparatus which forces padding into the cloth under pressure. It is then dried. No special attention need be paid to the lighting.

Colour Preparation.

This takes place in the colour shop. Contrary to the usual conception, barrels of powders or pastes are mixed by predetermined weight to the required colour. It is not usual for anything but good general lighting to be required.

Engraving Department: Designing and Etching.

Most of the problems common to illuminating engineering are met in this department, which handles valuable rollers and where mistakes would be very costly. The process of printing is by means of copper rollers on which designs have been engraved or etched, in the latter case leaving the design proud of the surface, as in the printing industry. The rollers themselves are costly and a separate roller is required for each colour in the pattern. Both from the standpoint of saving costly material and to ensure correct design the process requires good lighting. So far fluorescent tubing has been the most successful, and it is evident that this course has properties which render it particularly useful. The light on the operation itself, which should be supplementary to a good general diffused system, needs to be of a fairly high order, as although the patterns are never equivalent to small point type they may be quite intricate.

Printing.

After padding, the cloth, still on rollers, is mounted in the printing machines, together with the appropriate rollers on which the pattern has been engraved. The printer will need to see the design on the cloth as it comes off the finished roller, so that distortions either in colour or pattern may be corrected. Good lighting is absolutely essential, particularly at the point where the material leaves the rolls, and it should enable speedy detection of colour irregularities. The 5 ft. fluorescent tube has been found to answer the requirements of the industry for this inspection process. In rare instances yarn in hank or warp form may be printed to give a multi-coloured effect.

Ageing and Steaming.

This process is used to "fix" the dyes or to drive the pattern into the cloth and to prevent its easy removal. The material is passed through an enclosed steam box, which sometimes has a bulkhead fitting inside. Although the temperature is kept fairly high in practice, standard tungsten filament lamps have stood up to this quite satisfactorily.

Soaping and Padding.

These processes remove from the cloth printing pastes which have been used. The operation is quite elementary, after which drying takes place. General lighting is sufficient. After this stage of printing the material is ready to go to the soft warehouse for inspection and storage.

Soft Warehouse.

The finished products of the dyeing and printing sections are now collected, and from this stage the processes are identical. Apart from the inspection usually done in a comparatively small space the bulk of the room is storage space.

Mangling.

Cloth is passed through rollers to press it and remove heavy creasing.

Stentering.

It can easily be seen that the cloth passing through the earlier processes, because of constant wetting and drying, is subject to shinkage. This process is one in which the cloth is

stretched back to its original width and is almost entirely automatic.

Calendering.

The cloth now passes through calenders, the purpose of which is to iron it out by mechanical means. Diffused lighting is to be preferred.

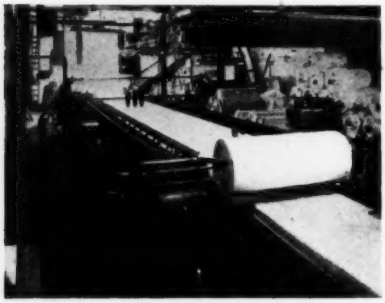

Fig. 6. Stentering. Whilst there is no reason why tungsten lighting should not be used the illustration shows how effectively it can be lit by fluorescent tubes.

Beetling.

The cloth, still on rollers, is passed in several thicknesses under wooden piles some 4 in. square. A row of these piles, operating in much the same way as pile drivers worked from a cam arrangement, hammer the cloth continuously. If care be taken in siting of lighting points to avoid heavy shadow, diffused lighting will be sufficient.

Schreinering.

This process is carried out on linings and needs careful lighting treatment. It consists of impressing pattern or linear designs in linings by means of pressure rams. It is thus separate from the other finishing operations and requires well-diffused lighting of not less than 12 ft.c. It is not so much a question of seeing the pattern in detail as of detecting pits in the cloth which would require the machine to be stopped and adjustments made.

Inspection.

Frequent inspection of the cloth is necessary; in fact, it occurs after every section of the finishing side. Good lighting is necessary, as inspection closely resembles perching; and since colours are involved colour correction is advantageous. Practically all these processes have been concerned in smoothing and stretching the finished cloth.

Warehouse.

There are no processes here requiring other than general lighting, as, with the exception of inspection, all are quite ordinary visual tasks. As has been mentioned previously, no elaborate mending is ever done in cottons. A faulty piece, if it got through to this stage, would simply be cut out. The cost of mending such comparatively low-priced material would be prohibitive. With the final operation of packing the finished cloth is ready for despatch to the retailer.

YARNS.

There are certain processes for yarns which do not appear under those headings already given, chiefly due to the fact that threads are being dealt with as distinct from cloth pieces. Whilst many of the operations are common, the following apply to yarn only.

Fig. 7. Hank Winding Room. Excellent results achieved by the use of fluorescent lighting. Considerable current saving resulted in this installation.

Yarn, of course, is the name given to the product from the spinning machine, that is, twisted cotton strand which has been reduced to its final thickness. Thus yarn in either bleached, dyed, or printed form may be sold or sent on to the polishing stage for such products as sewing cotton.

Bundling, chaining, or warping are usually carried out in the same room.

Bundling.

Yarn is sometimes reeled and bundled. Certain classes are exported in the form of reeled yarn in bundles, and some others, for bleaching and dyeing, are treated in a similar way. The process is not a difficult one.

Chaining.

This is really one method of warping. The large number of ends are gathered together side by side in the form of a rope and chained. This has exactly the same meaning as it has in crochet work.

Warping.

Is a process where a large number of ends of guaranteed length are wound side by side. Beam warps are usually used in grey work, but chain warps, ball warps, cross ball warps, and sectional warps may undergo some such process as bleaching or dyeing before being put on the weaver's beam.

Cassing.

This process for yarns corresponds to singeing for cloth. It consists in burning off loose fibres and is usually done for certain yarns intended for the lace trade or to imitate silk and very high classes of linen. The yarn usually passes through a hot gas flame. There are no special requirements excepting as given under singeing.

After being dyed the yarn passes through hydro-extraction, to which reference has been made under dyehouse mangling, and after this goes forward for re-winding. Certain yarns may pass in hank or warp form to the printing section and omit dyeing altogether. This is uncommon, except where multi-coloured yarns are required.

The only other process peculiar to yarns is that of polishing.

Polishing.

Certain yarns in the form of beams or hanks are treated with a type of size mixture and then very quickly brushed. This develops a high polish on the yarn such as that on sewing cotton. Care is necessary in positioning lighting points, and in view of the high polish diffused lighting is preferable. There are parts of machinery where a very highly polished metal finish is necessary.

The Wool Section

The finishing section of the wool industry is even more complicated than cottons, and whilst the flow chart shown in the paper dealing with this industry showed certain of the final processes, it was by no means complete. The processes concerned are those taking place after yarn has been spun or cloth woven, and in the latter case vary considerably according to the class of material. It will be understood that certain cloths having fancy coloured designs or colour mixtures coming from the loom may omit both bleaching and/or dyeing. The industry is, in many cases, subdivided into separate sections, each of which will specialise in a particular series of processes, whilst some concerns carry through the whole of the operations. Thus the manufacturer may in many cases send his woven cloth away to other concerns specialising in bleaching and dyeing, carbonising or shrinking, since these operations usually involve bulky machinery with consequent heavy requirements of floor space. Owing to the complex nature of the processes it has been found impossible to incorporate them all in one flow chart, and whilst the first flow chart gives the general layout it has been necessary to expand certain sections in other charts. That below deals specifically with cloth processing, whilst yarn will be found under the dyeing chart.

It will be seen that there are various processes peculiar to either the worsted or woollen sides of the industry, others are common to both. As in the case of cottons, considerable moisture is invariably present in "wet" processes and dust in "dry" processes. In dyehouses, for example, steam vapour is so heavy at times that it is almost impossible to secure light penetration.

It would be unwise to dogmatise on the actual grouping of operations in any particular room, as various manufacturers vary the flow, substituting additional minor processes to suit their particular product. The following grouping can, however, be taken as fairly general.

Mending Room.

Includes numbering and labelling, perching, knotting, burling, and

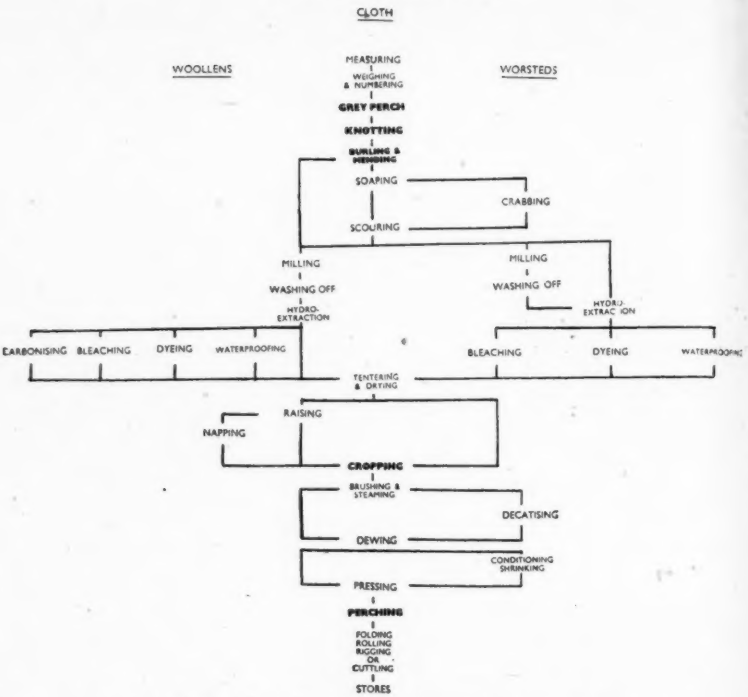

Fig. 8. Typical Flow Chart (Wool Industry). Finishing Processes.

mending processes. Particular attention should be given to the lighting system throughout the room.

Scouring Room.

Houses the following plant: crabbing and wet blowing, scouring, wringing, and hydro-extraction, milling and washing-off. They are all wet processes and suitable precautions should be taken.

Drying and Tentering Room.

The tentering and drying machine may be in the scouring room or in a smaller building leading off the main scour house. Hydro-exhausters or additions, such as beating apparatus, may be attached to the usual machines in special cases.

Raising Apparatus.

Depending on the size of the plant, raising machinery may be distributed in the scouring and dry-finishing rooms, or placed in separate rooms. This operation is almost exclusively associated with woollen finishing. The apparatus installed may be either for teazle raising or card wire raising, sometimes known as mosering.

Dry Finishing.

Includes cutting or cropping, brushing and steaming, dewing and damping, napping, perching.

Pressing Room.

Houses hydraulic or rotary presses and certain dry-blowing machinery. The latter may, however, be found in the dry finishing room.

Warehouse.

Perch inspection for texture and finish, stitching, measuring, and weighing, rigging, rolling, cuttling, cramping, parcelling, storage.

There are other sub-sections, which, as indicated earlier, are only shown in the main flow chart under headings, but which are specialised and

often carried out in independent premises working on commission. Special flow charts have been prepared on this basis.

Carbonising.

There is often a special factory devoted to this process, confined to woollens, details of which are given below.

Fig. 9. Wool Industry. Carbonising. Flow Chart.

Bleaching.

Is common to both woollens and worsteds, and is sometimes carried out in a separate building, dependent on the type of bleach being used. It may, however, be found in the scouring room or in the dye-house.

Dye-house.

Dyeing is often done by commission dyers, although this is not a hard and fast rule. The following flow chart is based on commission work, which includes certain preparatory processes which would not be undertaken if the firm did its own dyeing.

The premises can be roughly divided into three rooms—storage, dyehouse, and laboratory.

Storage Room.

Where the goods in yarn or piece form are received and stored until required. Includes all preliminary processes, including inspection of cloth.

Dyehouse Proper.

Includes dye vats, hydro extractors, and drying machines. Heavy vapour is always present. Dye mixing and blending is usually done in a separate room.

Laboratory.

Includes pot dyeing and matching samples. All modern finishing plant should have a well-equipped and well-lighted laboratory.

London Shrinking.

Separate factories are usually devoted to shrinking, the process being highly specialised. There are no intricate operations, but considerable floor space is involved.

Embossing.

This, together with numerous other highly specialised minor operations, is not general and has been omitted from specific description.

PROCESSES AND THEIR LIGHTING REQUIREMENTS.

The processes shown in thick type in the various flow charts for the wool industry should be treated with great care. They fall into categories as detailed below:—

(a) Processes which require medium visual perception (10 to 15 ft.c. range).
Cropping. *Inspection.

(b) Processes which require prolonged visual perception (15 to 25 ft.c. range).
Napping.
*Dye Inspection. *Laboratory.

(c) Processes which require severe visual perception (25 to 50 ft.c. range).
*Burling and Mending. Knotting.

(d) Precision processes (requiring over 50 ft.c.).
*Perching.

*Processes where light of approximate daylight characteristics would be an advantage.

Mending Department.

The department is really a receiving store, receiving the cloth from the

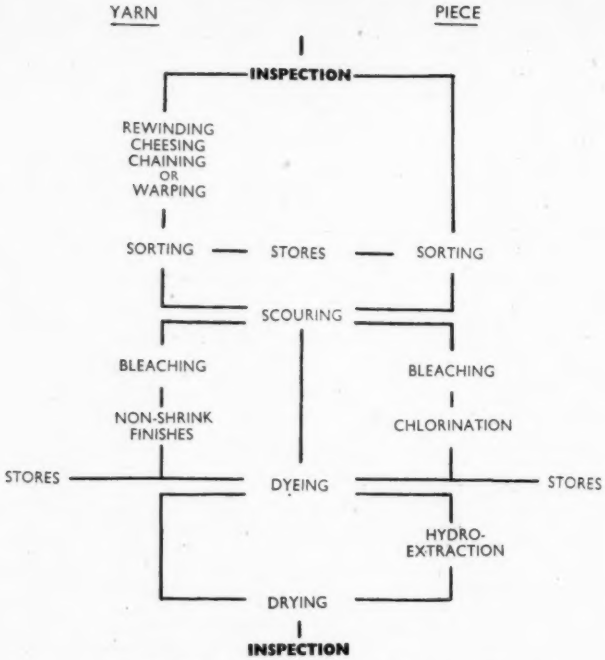

Fig. 10. Wool Industry. Dyeing (Commission).

looms and preparing it for the finishing processes. There should be a general illumination of approximately 6 to 10 ft.c., the reflectors being fitted with clear glass visors to simplify cleaning. In addition, supplementary lighting will be necessary where rather more intricate operations are carried out, such as perching, knotting, burling, and mending. All of these latter processes call for good lighting.

Measuring.

Consists of receiving the cloth from the looms and measuring for length and width. This is usually an automatic process and no special lighting is necessary.

Weighing and Numbering.

The cloth is weighed to ensure that the material is up to standard and numbered for identification purposes. The cloth is often received from several sources and some method of identification is necessary. Beyond general lighting there is no need for further assistance, as apart from reading the various labels no visual task is involved.

Perching.

Perching consists of rapidly drawing the cloth over upright perching frames, and is generally done in front of a large window facing north. At this stage it is known as "grey perching," texture faults being speedily detected, as the cloth is in more or less open form. In certain cases the surfaces are examined in turn, particularly where heavy cloth is being inspected. At this stage colour is ignored. It is obviously little use proceeding with finishing processes if faults are present in the cloth. In this and all similar operations it is generally agreed that a light source with characteristics closely corresponding to north-sky daylight would

be of advantage. A suitable method which has proved eminently satisfactory under test is to mount a fluorescent tube vertically on each side of the window embrasure and a further tube horizontally at the top. This latter tube might be separately switched so as to conserve current when low quality material is being inspected. When the lamps are in use daylight should be totally eliminated to ensure constant light quality as well as quantity.

Knotting.

Where knots are detected on the front of the cloth they are either removed or drawn through the cloth on to the back. This is often done on the perch.

Burling.

Picking the cloth with burling irons to remove foreign matter, such as burrs or chivs, loose ends, etc., which remained in the fibre after carding and spinning. The cloth is passed over a table something like a drawing-board and carefully examined. This is a manual process and needs good lighting, which can be either a fairly high standard of general lighting over the section dealing with this work or by supplementary localised lighting. Diffused lighting is to be recommended.

Mending.

Repairing cloth faults, inserting missing warp or weft ends. Missing threads often involving coloured work are put in by hand. Faulty yarn is removed and good yarn substituted. The work is intricate and very trying for the eyes. The process requires careful attention and good diffused lighting is essential, as the work is highly skilled. On many mending tables it is usual to provide lighting for colour correction, but there appears to be no reason why the fluorescent tube should not meet all the requirements where A.C. is available. There has been a growing practice to use adjustable fittings which allow the mender to raise or lower them at will, thus varying the illumination according to the colour of the material being processed. In general, variation of reflection factors do not warrant this, providing the lighting is diffused. In planning, care should be taken to provide adequate illumination for dark colours and to position lighting points so as to minimise shadows.

Scouring Room.

All of the operations carried out in this room are wet processes and vapour-proof fittings are needed. In no circumstances should flexible connections be used and all wiring should be in conduit. Shock-proof switches are essential. The illustration shown under this section gives an accurate picture of working conditions where considerable quantities of water or vapour are present at every stage. In most cases general lighting only is necessary, providing it is properly placed.

Crabbing or Wet Blowing.

This process is carried out in the worsted and dressed goods section of the trade but it is not necessary when processing heavy woollens. The cloth under tension is run open width on to a perforated roller, and boiling water and/or steam pumped through to set the cloth in a semi-permanent shape. The process develops the lustre of the material and removes unequal strains in the cloth. The tension and temperature are kept under control and the process often takes place in a semi-enclosed vat, the sole purpose of which is to act as a steam hood. There is no serious visual operation involved, the lighting being mainly necessary to inspect the indicators registering temperature and tension of the process. Apart, therefore, from placing the lighting fittings down the gangway in front of the vats, there is little need for specialised treatment.

Scouring.

Removing from the pieces such impurities as oil, added in the process of yarn manufacture, and dirt, collected in passing through the various machines. Piece scouring usually takes place in a semi-enclosed vat and is done in either open width or rope form. In either case a small batch of pieces are first washed in some detergent, usually soap and soda, going through rollers under pressure. The process is continuous and the pieces are rinsed in the same machine. During these processes the material is

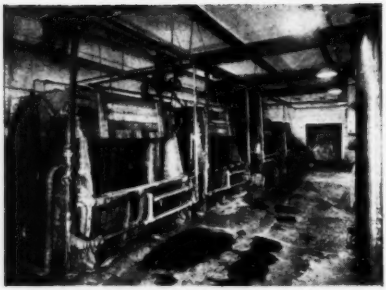

Fig. 11. Piece Scouring. The presence of considerable quantities of water can be seen. Condensation is always present. Lighting is usually provided as shown.

being gradually worked up to the desired finish. Lighting suitable for all the requirements of wet operations can well be of a general dispersive type, placed in front of the vats as shown in the illustration.

Wringing and Hydro-extraction.

Only comparatively heavy fabrics are wrung, but practically all may be hydro-extracted at some time during finishing. Sometimes referred to as "wuzzing" or "centrifuge," hydro-extracting consists of removing the maximum amount of water in the piece by centrifugal force.

Fig. 12. Milling. A "wet" process sometimes carried out in wooden structures as shown. Good general lighting at the front and top is satisfactory.

Milling.

A process mainly applied to woollens, but some worsteds are lightly milled, during which the cloth is shrunk and thereby increased in thickness. The cloth in a moist, warm condition is fed between weighted rollers and pushed down a constricted trough so that considerable rearrangement of the fibres takes place. The cloth is converted from a sack-like material in which the weave structure is clearly visible, into a compact fabric of indeterminate weave structure. Two types of machine may be used:—

(a) Milling stocks, which hammer the cloth, imitating the treading action of human feet.

(b) Milling machine, which operates on a squeezing principle both in length and width.

Lighting similar to that for scouring is recommended.

Washing Off.

The removal of soap and unfixed colouring which had been used in the milling process by passing the cloth through water.

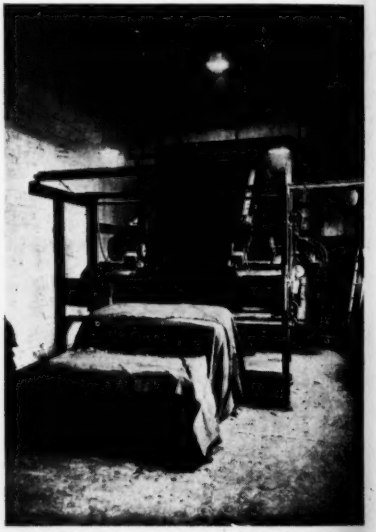

Fig. 13. Tentering and Drying. Steam is always present. Protection for the light source should be provided.

Tentering and Drying.

The cloth is hooked on to a pair of travelling chains and stretched in width between the chains. Whilst under tension moisture is removed

from the pieces by passing them over steam-heated pipes or hot air to straighten the piece, standardising its width, and finally dry it by the application of heat. Lighting is required over the whole of the piece as it passes through the process, and can well be done by general means. There is, of course, considerable humidity in the atmosphere.

Raising Apparatus.

Woollen cloths which have been milled can have fibres drawn from the body of the cloth to give a different fibrous cover or pile on the surface. This can be done by

(a) a vegetable teazle, or
(b) card wires.

The first, commonly known as "teazling," is usually carried out wet and is much more severe on the cloth. The pile is raised and laid in one direction, termed "a trailled or dress-faced pile." Teazling is used on the better cloths.

The second is known as "mosering," and is usually carried out on comparatively dry cloths. The surface of the cloth is pulled up by the card wire, which acts as a very rough brush. A vertical or erect pile is obtained. The illustration shown is of the "mosering" process, from which it will be seen that the machine is bulky, and although there is no outstanding visual task the lighting should be so arranged that the piece can be seen during the whole of the process.

Burling.

Following "raising," the cloth is often "burled" again to remove any vegetable matter left by "teazling" or "slubs" or "naps." As indicated previously, the lighting should be treated in the same way as for a burling process.

Fig. 14. Raising (Mosering). Note the overhead bulk preventing free access of light on to the card wires. Localised lighting is often necessary.

Dry Finishing.

After the wet processes, the material passes on to the dry finishing side, and although there is now little or no vapour there is a considerable amount of dust from the materials. Fittings should be covered with clear glass visors to prevent dust settling on the reflecting surfaces and to provide easy cleaning facilities.

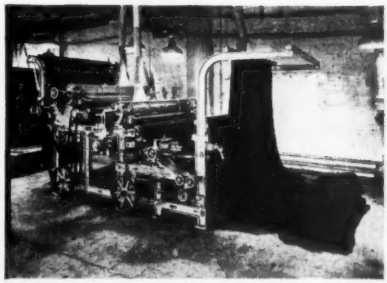

Fig. 15. Cutting or Cropping. Good lighting is necessary on the cutters. Special attention is necessary at the delivery end of the machine.

Cutting or Cropping.

Many worsted suitings are given a clear finish. Such cloths are "cropped" to remove any fibres that may have appeared on the face. The cloth is passed over a "vee-bed," over which is mounted a rotating cylinder carrying blades which slice off the fibres against a stationary ledger blade. Even cloths having a definite fibrous cover are sometimes "cropped" to give a uniform height to the pile. The degree of cutting varies according to the type of cloth. Whilst it is true that the operative can tell by the sound whether the machine is operating satisfactorily, it is nevertheless essential that lighting should be directed on the piece at a suitable angle, particularly as it leaves the machine. This is often somewhat difficult in view of the guards which have to be fitted, and the lighting will therefore, need to be specially dealt with on site.

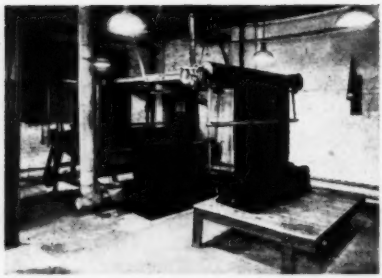

Fig. 16. Brushing and Steaming. Steam and dust necessitate clear visors on all fittings. Careful siting is called for to minimise shadow.

Brushing.

The cloths, having a light fibrous cover, are often brushed to lift the fibres. This may be done at two stages:

(a) After scouring, milling, etc., in order to raise or straighten the fibres prior to cutting or cropping; or

(b) The combined process of brushing and steaming, which may be applied to the fibres both before and after cutting. After cutting it is applied to remove any loose fibres which may remain on the cloth and to strengthen the pile.

The process is entirely automatic. As a little steam is present and also a certain amount of dust rises from the material, it is advisable to use cover glasses for the fittings. Due to the amount of overhead gear which is present, it is often found most convenient to group the light sources round one of the machines as shown in the illustration.

Decatizing.

The setting of the piece is done by blowing steam, immediately followed by drawing cold air through the piece, which is under slight tension on a perforated cylinder. The object of the process sometimes called "lustring," is to give a more permanent lustre. There is no need for other than general illumination.

Dewing and Damping.

In which the fabric is treated by contact with a wet cotton wrapper or with a fine uniform spray of water. Its purpose is sometimes to shrink the piece and sometimes to condition it prior to hot pressing. There is no need for a special lighting treatment.

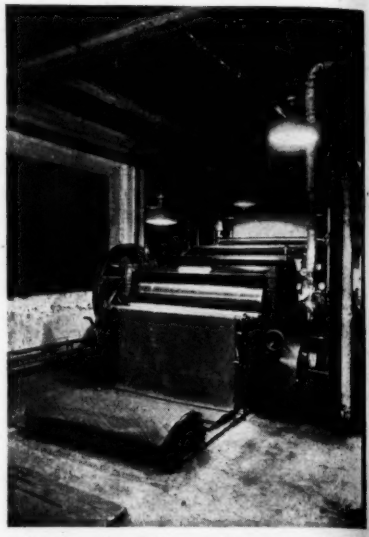

Fig. 17. Rotary Press. As in most "dry" processes use is made of visor fittings, the units being grouped as shown.

Napping or Friezing.

A development of the raising which consists in rubbing the raised fibre into small beads or "curls," producing a distinct pattern effect. It is a specialised process which needs special lighting treatment.

Pressing.

An ironing process. There are two main types of machine. In the rotary press the cloth passes continuously between a rotating heated cylinder and a heated concave bed. The pressure is regulated by a hydraulic ram under the concave bed. In the ordinary hydraulic press the process is intermittent. It is automatic, and its object is to press or flatten the cloth, at the same time consolidating the fabric and giving it a certain amount of lustre.

Steaming Off.

Consists in allowing steam to pass through the fabric to remove excess lustre after pressing and conditioning it.

Cold Flatting.

To reduce the slight roughness given to the piece due to steaming off. The piece is merely pressed cold and general lighting is all that is necessary in these latter processes.

Final Perching.

Final perching is extremely important, since this is the final inspection before the material is passed for making up. As in the case of grey perching, vertical frames are used and the cloth is passed over a table, being examined for uniformity, shade, rubbing of colour, and for any defects in appearance or finish. Special lighting is necessary both as regards quantity and quality which could well be suppled in much the same way as that recommended for grey perch.

WAREHOUSE.

Measuring and Weighing.

The final process of checking length, width, and weight of individual pieces.

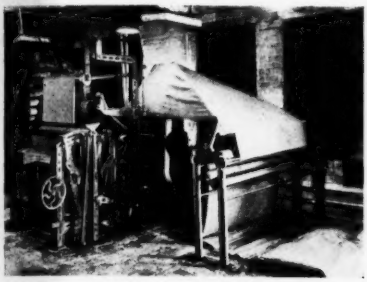

Fig. 18. Rigging, Folding and Cuttling. The illumination has been provided in this case by clear visor units to permit easy removal of fluff deposit.

Rigging, Folding, Rolling, and Cuttling.

Rigging and cuttling consists in folding the pieces lengthways and in the width for ease of carriage and packing.

Rolling is merely putting the piece on to a piece board as required by a customer.

The processes are carried out on the same machine according to the requirements of the customer.

It will be appreciated that in dealing with the flow chart it has been necessary to omit certain alternative operations which are in themselves separate sections of the textiles, such as carbonising, bleaching, dyeing, shrinking, etc., none of which is invariably included in any particular flow. With the exception of London shrinking, these processes would generally take place after milling both woollen and worsted cloth.

Carbonising.

Really a series of processes carried out to eliminate cellulosic material, such as cotton threads or burrs from the fabric. Provision has to be made for impregnating the cloth with acid, hydro-extracting and wringing,dyeing, and baking, beating in a milling machine, neutralising, and washing in a dolly machine. There are no special lighting requirements, but there is a considerable amount of moisture in the atmosphere and vapour-proof fittings are advisable. Carbonising is confined to the woollens.

Bleaching.

The process of bleaching differs according to the bleaching agent used. It is often done in the scouring room in dollies or similar machines specially set aside for the purpose. Hydrogen peroxide or sulphites are the usual bleaching compounds used, which have no serious corrosive effect. The lighting can therefore be treated in exactly the same way as for the rest of the scouring room detailed earlier.

Where, however, sulphur stoving is carried out, usually in a separate room, particular care must be taken to protect lamps, fittings, and wiring against corrosive action.

Dyeing.

The operation of dyeing, i.e., applying and developing dyes to pieces or yarn, is really a series of processes usually carried out by separate factories which specialise in this on a commission basis. This gives the section the name of commission dyers.

The preliminary operations to prepare the cloth or yarn for dyeing are carried out in the storage room.

STORAGE ROOM.

Cloth Inspection.

Is a perch operation as a check on manufacture to ensure that no faults

are present in the texture of the cloth. The cloth is run over a vertical perch and viewed from the back where possible. Looking through the cloth faults are readily detected, but in many milled cloths it would not be possible to do this and surface examination must suffice. The usual lighting requirements for perching are necessary.

Sorting.

After inspection, the cloth, which may have come from several sources, is assorted for bleaching and/or dyeing. Several pieces, usually of 70 yards each, may all require the same dye. Yarn is received and sorted, passing through various preliminary processes such as rewinding, chaining, etc. (as in cottons), determined by delivery requirements.

After these processes cloth or yarn may come into storage until required.

DYE-HOUSE.

As mentioned earlier, colour matching or mixing rarely, if ever, takes place in the dye-house. In woollens space is usually provided for loose wool dyeing and the necessary drying plant, and in the case of worsteds for slubbing dyeing. There is always plenty of water and heavy vapour present. Condensation is very heavy, and it is quite common after the plant has been standing idle for a day or two for water to drip from beams, pipes, fittings, etc. Vapour-proof fittings should invariably be used.

Scouring.

Both cloth and yarn pass through the scouring process which removes extraneous substances and cleans the material.

Dyeing.

The process is carried out in vats similar to those in other wet processes. Water gets everywhere and lies in puddles on the floors. Both cloth and yarn for dyeing are passed through the vats, the dye being at a predetermined temperature for a definite time. It is customary then for a small sample of the material to be taken and matched in the dyer's office, and further dying depends on the dyer's instructions as to tint which may require slight adjustment. The actual dyeing of the piece is elementary and is done by semi-skilled labour only. The main requirements of the lighting are that it shall penetrate a steam-laden atmosphere.

LABORATORY.

This should include provision for pot dyeing and matching samples and should be well lit. Sample dyeing usually determines the weight formula for the actual dyeing process. Arrangements should be made for colour matching at selected points. The dyers will usually be given any kind and amount of light they require by the firms concerned, as their work is extremely important. Diffused lighting should be installed throughout.

Conditioning.

At certain stages during the finishing of wool fabrics, for example after drying and tentering, cloths are damped and then stored in a cool cellar or room into which a little steam may be admitted. This operation improves the "handle" of the cloth. Simple machines have been devised in an attempt to produce similar effects more quickly. General lighting is satisfactory.

London Shrinking.

The cloth is damped and hung over bars in a room with controlled temperature and humidity until all the strains in the cloth are eliminated. Even after this process it has been known for a shinkage of two inches in a yard of material to take place. The layout of the plant, although not complicated, demands much floor space.

This paper brings the Textiles up to the stage where it is ready for delivery to the "making up" side.

In conclusion, the author wishes to acknowledge the consent of the E.L.M.A. Lighting Service Bureau for the presentation of this paper and to express his appreciation to the Textile Department, Leeds University, and numerous textile manufacturers, who have assisted by providing information and checking detail, without which the paper could not have been presented.

PROVISIONAL PROGRAMME OF MEETINGS

(SESSION 1943-1944)

SESSIONAL MEETINGS IN LONDON

Unless otherwise announced, meetings will be held at **5.0 p.m.**

1943.

Tuesday, Oct. 12th. Paper on **The Design and Application of Fittings for Tubular Fluorescent Lamps,** by W. R. STEVENS. (*To be held at the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2.*)

Tuesday, Nov. 9th. Paper on **The Lighting of Public Buildings,** by MR. W. T. F. SOUTER. (*To be held at the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2.*)

Tuesday, Dec. 14th. A Discussion on **Street Lighting Specifications of the Future; Should they be based on the Design of the Unit or the Effect of Illumination,** to be opened by DR. S. ENGLISH and MR. R. MAXTED. (*To be held at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1.*)

1944.

Tuesday, Jan. 18th. A Discussion on **The Art and Science of Illumination.**

Tuesday, Feb. 8th. **Address by the President** (DR. H. BUCKLEY).

Tuesday, Mar. 14th.
Tuesday, April 18th. Papers on **The Lighting of the Homes of To-morrow; The Predetermination of Industrial Lighting; Demonstrations illustrating Fundamental Principles and Effects of Illumination**

Tuesday, May 9th. **Annual General Meeting.** Address by SIR CHARLES DARWIN (Director of the National Physical Laboratory).

BATH AND BRISTOL CENTRE (WESTERN AREA)

(*Joint Hon. Secretaries:* R. E. TUCKER, 7-8, Wine Street, Bath; D. J. SAWKINS, 86, Redcliffe Street, Bristol.)

Unless otherwise announced, all meetings will commence at **7.0 p.m.,** *those in Bath being held in the Pump Rooms, and those in Bristol at the Grand Hotel, Broad Street.*

1943.

Sept. 20th. **First General Meeting,** Election of Officers; **Address on Work of Centre.**

Oct. 4th. **Address by Chairman of Centre** (MR. J. B. HARRIS) (*held in the Pump Room, Bath*).

Nov. 1st. Address on **Post-War Lighting Reconstruction** (*in Bristol*).

Dec. 6th. Lecture on **The Future of Fluorescent Lamp Lighting** (*in Bath*).

1944.

Jan. 3rd. Lecture on **Foot Candles, Lumens, and All That,** by MR. E. J. IRELAND (*in Bristol*).

Feb. 7th. **"Brains Trust" Meeting** (*in Bath*).

Mar. 6th. Address by **The President** (DR. H. BUCKLEY) (*in Bristol*).

April 3rd. Lecture on **The Application of Plastics to Modern Lighting Fittings.**

May 1st. **Second General Meeting:** Election of Officers for Session 1944-1945 (*in Bristol*).

BIRMINGHAM CENTRE (MIDLAND AREA)

(*Hon. Secretary:* C. J. ALLDERIDGE, 125, Moor Street, Birmingham).

Unless otherwise announced, Meetings to be held at the Imperial Hotel, Temple Street, Birmingham, at **6.0 p.m.**

1943.

Oct. 15th. **Address** by THE CHAIRMAN (MR. A. J. PASHLER.)

Nov. 12th. **"Brains Trust"** Meeting.

Dec 10th. Address on **The Poetry of Light,** by MR. R. GILLESPIE WILLIAMS, (*To be held at the Crescent Theatre, Birmingham.*)

1944.

Jan. 28th. Short Papers forming a **Symposium on Lighting.**

Feb. 25. Paper on **Electric Lighting: A Contractor's Viewpoint,** by MR. J. ASHMORE.

Mar. 24th. Paper on **The Thyration and Some of its Applications,** by MR. A. J. MADDOCK. (*Joint Meeting with the Institute of Physics: Meeting Place to be announced.*)

April 21st. **Address** by THE PRESIDENT (DR. H. BUCKLEY).

May 19th. Address on **Light as an Aid to Medicine,** by DR. JAMES F. BRAILSFORD.

PROVISIONAL PROGRAMME OF MEETINGS (SESSION 1943—1944)

CARDIFF CENTRE (SOUTH WALES AREA)

(*Hon. Secretary:* S. G. TURNER, Mervyn House, Frederick Street, Cardiff.)

Unless otherwise announced, Meetings will be held in the Cardiff Corporation Demonstration Theatre, The Hayes, Cardiff, at **3.0 p.m.**

1943.

Sept. 9th. Lecture on **The Control of Light by Glassware,** by DR. S. ENGLISH.

Oct. 9th. Lecture on **The Physiological Aspects of Lighting,** by DR. J. H. SHAXBY. (*To be held at the Mackworth Hotel, Swansea.*)

Nov. 11th. Paper on **Avoiding the Obsolete in Street Lighting,** by MR. F. F. MIDDLETON.

Dec. 9th. A Review of Lighting by an Architect.

1944.

Jan. 10th. A Paper by a Gas Engineer.

Feb. 4th. Paper on **Progress of Lighting in Industry,** by MR. S. G. TURNER. (*Joint Meeting with South Wales Institution of Engineers, at Neath.*)

GLASGOW CENTRE (SCOTTISH AREA)

(*Hon. Secretary,* M. W. HIME, E.L.M.A. Lighting Service Bureau of Scotland, 29, St. Vincent Place, Glasgow, C.1.)

Unless otherwise announced meetings will be held in the "Cadora" Restaurant, Glasgow, at **6.0. p.m.**

1943.

Oct. 29th. Address by MR. J. W. HOWELL. (*Joint Meeting with the Glasgow Centre and the Society of Dyers and Colourists, to be held in the St. Enoch Hotel, Glasgow.* **6.30 p.m.**

Nov. 24th. Paper on **Ripple Control.**

1944.

Jan. 21st. Paper on **Lighting Developments in the Gas Industry,** by MR. W. J. G. DAVEY.

Feb. 18th. Address by **The President** (DR. H. BUCKLEY).

Mar. 24th. Paper on **Fluorescent Lamps.**

LEEDS CENTRE (NORTH MIDLAND AREA)

(*Hon. Secretary:* R. PYE, 46, Wellington Street, Leeds, 1.)

Unless otherwise announced meetings will be held in the Leeds Corporation Electricity Showrooms, The Headrow, Leeds, at **5.15 p.m.**

1943.

Oct. 4th. "Brains Trust" Meeting.

Nov. 5th. Paper on **Fundamentals of Lighting Design,** by MR. W. J. JONES.

Dec. 6th. Address by THE CHAIRMAN of the Centre (MR. A. KELSO). Followed by **Discussion on the Education and Training of the Illuminating Engineer.**

1944.

Feb. 7th. Paper on **Lighting in the Dyeing, Bleaching and Finishing Industry,** by MR. J. W. HOWELL.

March 6th. Paper on **Photo-electric Photometers,** by MR. J. S. PRESTON.

April 3rd. Paper on **Lighting in the Tailoring and Garment Making Industry.**

May 1st. Annual General Meeting. Address by THE PRESIDENT (DR. H. BUCKLEY).

In this list a provisional list of meetings in prospect is given. All available particulars of forthcoming events have been included, but in some instances programmes have not yet been completed. Local conditions may lead to certain changes, for example, in regard to times and places of meetings, but any such modifications will be announced to members interested. In the meantime members are advised to keep the following list for reference purposes.

PROVISIONAL PROGRAMME OF MEETINGS (SESSION 1943—1944)

MANCHESTER CENTRE (NORTH WESTERN AREA)

(*Hon. Secretary:* ALAN H. OWEN, 11, Albert Square, Manchester.)

Unless otherwise announced meetings will be held in the Reynolds Hall, College of Technology, Sackville Street, Manchester, at **2.30 p.m.**

1943.

Oct. 14th. Paper on **Lighting in the Textile Finishing Trades,** by MR. W. J. HOWELL.

Nov. 11th. Paper on **Short Cuts in Illuminating Engineering,** by MR. W. J. DAVEY.

NEWCASTLE CENTRE (NORTH EASTERN AREA)

(*Hon. Secretary:* STUART D. LAY, Ellison Buildings, Ellison Place, Newcastle-on-Tyne, 1.)

Unless otherwise announced meetings will be held in the Minor Hall, Oxford Street, Newcastle-on-Tyne, at **5.30 p.m.**

1943.

Oct. 6th. Paper on **Lighting in Relation to Town and Country Planning,** by MR. J. H. NAPPER.

Nov. 3rd. Paper on **The Development of Illuminating Engineering,** by MR. J. M. A. MITCHELL.

Dec. 1st. Paper on **The Redistribution of Light by Glassware,** by DR. S. ENGLISH.

1944.

Jan. 5th. **A Series of Short Papers.**

Feb. 2nd. Paper on **Post-War Street Lighting,** by MR. E. C. LENNOX.

Mar. 2nd. **Address** by THE PRESIDENT (DR. H. BUCKLEY).

April 6th. **Annual General Meeting.**

NOTTINGHAM CENTRE (MIDLAND AREA)

(*Hon. Secretary:* C. S. CAUNT, 62, Thackeray's Lane, Woodthorpe, Nottingham.)

Unless otherwise announced meetings will be held in the Lecture Theatre of the City of Nottingham Gas Department, Parliament Street, Nottingham, at **5.30 p.m.**

1943.

Aug. 27th. **Annual Meeting. Address** by THE CHAIRMAN (MR. A. HACKING).

Sept. 24th. **A "Brains Trust" Meeting.**

Oct. 29th. Discussion on **Lighting Reconstruction** to be opened by MR. R. GILLESPIE WILLIAMS.

Nov. 25th. Paper on **The Physics of the Discharge Lamp,** by PROF. H. COTTON.

1944.

Feb. 25th. **Address** by THE PRESIDENT (DR. H. BUCKLEY).

Mar. 24th. Paper on **Light Control of Glassware,** by DR. S. ENGLISH.

April 23th. Paper on **Applications of Low Pressure Fluorescent Lamps,** by MR. W. R. STEVENS.

SHEFFIELD CENTRE (NORTH MIDLAND AREA)

(*Hon. Secretary:* J. A. WHITTAKER, Magnet House, Fitzalen Square, Sheffield, 1.)

Unless otherwise announced meetings will be held at the Central Library (entrance, Tudor Place), Sheffield, at **6 p.m.**

1943.

Nov. 6th. **A "Brains Trust" Meeting.**

Dec. 6th. Paper on **Infra-Red Radiation and its Application to Industry,** by MR. J. O. L. ST. CLAIR.

1944.

Feb. 7th. Paper on **The Precise Control of Light by Glassware,** by DR. S. ENGLISH.

Mar. 6th. Lecture and Stage Demonstration on **The Poetry of Light,** by MR. R. GILLESPIE WILLIAMS.

April 3rd. Paper on **Post War Planning of Lighting in Dwellings and Public Buildings,** by MR. J. T. GRIMSHAW. (For Members only.)

May 8th. Paper on **Special Lighting Problems with Particular Reference to Industry,** by MR. J. W. HOWELL.

PROVISIONAL PROGRAMME OF MEETINGS (SESSION 1943—1944)

BRADFORD GROUP (NORTH MIDLAND AREA)

(Hon. Secretary: A. J. HUTCHINSON, 27, Bolton Road, Bradford.)

Unless otherwise announced meetings will be held in Bradford Electricity Department Showrooms Sunbridge Road, Bradford, at **6.45 p.m.**

1943.

Sept. 23rd. Discussion on **Post-War Domestic Lighting,** to be opened by MRS. L. J. DAVIES.

Oct. 14th. Paper on **Post-War Developments in Colour Lighting,** by MR. R. GILLESPIE WILLIAMS.

Nov. 11th. Paper on **School Lighting,** by MR. T. JONES.

Dec. 9th. Paper on **Infra-Red Radiation: Its Industrial Application,** by MR. I. QUIGLEY.

Dec. 29th and 30th. Christmas Lectures for Children, by MR. R. O. ACKERLEY *(Times to be announced later).*

1944.

Jan. 13th. Paper on **Lighting in the Bleaching, Dyeing, Printing, and Finishing Industries,** by MR. J. W. HOWELL.

Feb. 10th. Lecture on **The Eye,** by MR. W. H. WELLWOOD FERGUSSON.

March 9th. Paper on **Neon Signs in Post-War Years.**

April 13th. Paper on **Industrial Lighting by Gas,** by MR. W. HODGKINSON. *(To be held at the Bradford Gas Department Showrooms, Britannia House, Bradford.)*

DERBY GROUP (MIDLAND AREA)

(Hon. Secretary: C. S. WHEELER, Grove Mansions Burton Road, Derby.)

Unless otherwise announced meetings will be held in the Borough of Derby Electricity Showrooms, Irongate, Derby, at **6 p.m.**

1943.

Sept. 7th. Paper on **Lighting Principles,** by MR. J. B. SAUNDERS.

Oct. 5th. Paper on **The Poetry of Light,** by MR. R. GILLESPIE WILLIAMS.

Nov. 2nd. Paper on **The Eye: Its Reaction to Light,** by MR. G. H. BAMFORD.

Dec. 7th. Paper on **Planning an Industrial Lighting Scheme,** by MR. C. J. ALLDERIDGE.

1944.

Feb. 1st. Paper on **Electric Discharge Lighting,** by MR. A. L. RANDALL.

March 7th. Paper on **Infra-Red Radiation,** by MR R. MAXTED.

April 4th. Address by THE PRESIDENT (DR. H. BUCKLEY).

May 2nd. Paper on **The Future Development in Electric Lighting Technique,** by MR. T. S. JONES.

LEICESTER GROUP (MIDLAND AREA)

(Hon. Secretary: G. BINGHAM, 478, Welford Road, Leicester.)

Unless otherwise announced meetings will be held in the Leicester Corporation Electricity Department, Demonstration Theatre, Charles Street, Leicester, at **6. p.m.**

1943.

Sept. 7th. A **"Brains Trust"** Meeting.

Oct. 5th. A Paper on **An Architect's Viewpoint,** by MR. G. A. COPE.

Nov. 2nd. A Paper on **Stage Lighting,** by MR. R. GILLESPIE WILLIAMS.

Dec. Annual General Meeting.

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

With a view to avoiding possible confusion with other publications, reference to these Transactions should be in the form :—" Trans. Illum. Eng. Soc. (London)."

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